

FDR-700 Series

Diffuse Reflectance Immersion Probes

Fiber-optic coupled Near-IR and UV-Visible probes for the analysis of scattering substances in any form.



FDR Series diffuse reflectance probes make possible the remote analysis of a wide range of substances in virtually any industrial setting. Optimized for use with bifurcated single fibers

or small diameter bundles, they provide economical operation at distances of tens or even hundreds of meters from the spectroscopic analyzer. Since they are purely passive—requiring no electrical power—they can be used in hazardous environments without the need for special packaging or operator precautions. Applications range from the surface analysis of opaque solids to the analysis of powders, foods, polymer melts, and scattering liquids.

FDR-750 Polymer Melt Probe

Model FDR-750 is mounted in the 1/2, 20 UNF “Dynisco compatible” fitting that is commonly used in the polymer industry. This, combined with its high temperature and pressure ratings, make it ideal for on-line monitoring of polymer melts containing inorganic powders or other scattering centers.

FDR-780 Process Probe^{1,2}

Model FDR-780 has been developed to provide maximum long term reliability under the extreme conditions of high temperature, thermal shock, and aggressive chemistries encountered in many on-line process applications. The key element of this design is a proprietary window sealing technique involving a direct sapphire to Hastelloy welded pressure seal.² This approach eliminates the fatigue and stress

Features

- Compatible with remote operation
- Suitable for immersion in chemical processes
- Purely passive and non-hazardous
- Detachable from cable for ease of maintenance
- Large depths of field
- Compatible with high temperatures and pressures (FDR-750, 780, & 790)
- Compatible with highly aggressive chemicals (FDR-780 & 790)

FDR-730 Compact Probe¹

The light weight and small diameter of model FDR-730 make it ideal for hand-held operation as well as for automated applications involving a confined space. Other features include a large viewing area (6.4 mm diam.), which is important when analyzing inhomogeneous samples, and a large depth of field (6 mm). The latter feature allows it to monitor diffusely reflecting samples through a transparent medium such as a vial wall.



failures common with brazed seals, and the high temperature and thermal cycling limitations of elastomeric seals. It provides reliable long-term operation at temperatures as high as 300°C.

FDR-790 Process Probe^{1,2}

The FDR-790 has been design-ed to approach the theoretical maximum possible signal level when coupled to a spectrometer by means of a bifurcated pair of single 600 µm core optical fibers. The use of single core fibers provides for economical remote operation while allowing several probes to be efficiently multiplexed to a single spectroscopic analyzer. In addition, the probes can be provided in sufficiently long lengths to allow retraction from a process by means of Axiom's PRM Series retraction mechanisms. The absence of an internal air volume makes these probes intrinsically safe and free of interferences from atmospheric absorbance.

Probe/Spectrometer Coupling

FDR-730, 750, and 780 probes are typically coupled to a near-IR spectrometer by means of a small diameter bifurcated fiber-optic bundle, such as the Axiom Model FDB-302. This consists of eighty fibers forming a bundle 2.4 mm in diameter at the probe's SMA connector. At the spectrometer, this is split into two bundles of forty fibers each to serve as the transmit and receive legs. In applications requiring especially long fiber runs, it is also possible to couple the probe by means of a bifurcated single fiber pair such as Axiom model FDS-202. Although the use of

single fibers does reduce the available signal, the level is still adequate for many demanding applications. As noted above, the FDR-790 probe is optimized to provide the maximum possible signal level when used with a bifurcated single fiber cable. For process applications, the cable is usually run through a conduit. To accommodate this, each probe is provided with a threaded fitting to interface to a conduit termination housing (Axiom model FCH-22 or FCH-24). These housings also provide heat sinking for applications involving high process temperatures, and a purge input point to allow probe isolation when operating in a humid environment.

Probe/Process Interfacing

Model FDR-650 is mounted in a standard 1/2, 20 UNF extruder fitting. Other models can either be attached to a process vessel or pipe by means of a variety of optional welded-on flanges or pipe fittings.

Accessories

FDB-302 Bifurcated Fiber-Optic Bundle: Two meter length; Equipped with SMA connectors; Active diameter: 2.4 mm at probe, 1.7 mm at source and detector terminals.

FDS-202 Bifurcated Single Fiber Pair: Two meter length; Equipped with SMA connectors; Active diameter at source and detector terminal: 0.6 mm.

FCH-24 Conduit Termination Housing, Heat Sink, And Vapor Isolator: Encloses fiber optic connections while providing heat sinking and proper termination for a protective conduit; Includes

1/8 NPT purge fitting.

FOI-5XYR Fiber-Optic Sample Compartment Interface: For use with FT-NIR spectrometers and other spectrometers with internal sample compartments. Includes pick-off and return optics, purge shrouds, SMA connectors, and mounting plate to match user specified spectrometer. "XY" denotes spectrometer make and model.

For more information, or to discuss your specific application, please do not hesitate to contact us at 1-800-goaxiom or visit us on the web at www.goaxiom.com.

References

1. U.S. Patent No. 6,563,992 *B1*
2. U.S. Patent No. 6,587,195 *B1*

Relevant Technical Notes: AN-916, AN-922, AN-923 (download from website or call for a copy).

FDR Series Diffuse Reflectance Probe Specifications

	FDR-730R	FDR-750R	FDR-780R	FDR-790R
Spectral Response: R = N R = U	400–2200 nm 200–800 nm	400–2200 nm 200–800 nm	400–2200 nm 200–800 nm	400–2200 nm NA
Illuminated Spot Diameter:	6.4 mm	3.2 mm	6.4 mm	1.5 mm
Depth of Field (1/2 signal):	6 mm	3 mm	6 mm	2 mm
Maximum Stray Light:	1%	10%	2%	5%
Body Type:	Straight. 12.7 mm diam.	½, 20 UNF fitting.	Straight. 16 mm diam.	Straight. 12.7 mm diam.
Insertion Length:	15 cm	Flush with bore	15 cm	60 cm, std. others available
Maximum Temperature:	200°C	250°C	300°C	250°C
Maximum Pressure:	50 bar	300 bar	300 bar	100 bar
Material of Construction:	316 stainless steel	316 stainless steel	Hastelloy C-276	316 stainless steel
Window Material:	Sapphire	Sapphire	Sapphire	Sapphire
Window Seal:	High temperature Epoxy	Braze	High-nickel C-ring in welded structure	Grafoil™ in welded structure
Recommended Fiber-Optic Cable:	FDB-3xx bifurcated bundle or similar	FDB-3xx bifurcated bundle or similar	FDB-3xx bifurcated bundle or similar	FDS-3xx bifurcated single fiber pair or similar
Fiber-Optic Connector:	SMA-905 female	SMA-905 female	SMA-905 female	SMA-905 female